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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/032,275	12/21/2001	Alain Duboust	005998	12 ⁴⁰⁵²

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APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER

PARSONS, THOMAS H

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 09/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicant N .

10/032,275

Applicant(s)

DUBOUST ET AL.

Examiner

Thomas H Parsons

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12-34 and 43 is/are allowed.
- 6) ☒ Claim(s) 1,5-8,10,11,35,39,41 and 42 is/are rejected.
- 7) ☒ Claim(s) 2-4,9,36-38 and 40 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 April 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4,5,10,11
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

Page 11, line 8, after "November 29, 1999, suggest inserting --(now U.S. Patent No. 6,379,223)--

Appropriate correction is required.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "270" as mentioned on page 9, line 6. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 39, 41 and 42 are rejected under 35 U.S.C. 102(e) as being anticipated by Emesh et al. (2002/0108861)

Claim 39: Emesh et al. in Figure 4 disclose a method for planarizing a surface of a wafer (60), comprising polishing the wafer in an electrolyte composition comprising a phosphate system, wherein the wafer (60) is connected to an electrical power source (90) (page 3, paragraph [0037], and page 4, paragraphs [0045], [0046] and [0047]).

Claim 41: Emesh et al. in Figure 4 disclose method for planarizing a surface of a wafer (60), comprising: connecting the wafer (60) to a positive terminal of an electrical power source (90); disposing the wafer in an electrolyte composition comprising a phosphate system; and removing materials from the surface of the wafer disposed in the electrolyte composition (page 3, paragraph [0037], and page 4, paragraphs [0045], [0046] and [0047]).

Claim 42: Emesh et al. in Figure 4 disclose that the electrolyte composition comprises one or more additives selected from the group consisting of benzotriazole, ethylenediamine, amino acids, and citric acid (page 3, paragraphs [0037], [0038], and [0041]).

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claim 35 is rejected under 35 U.S.C. 102(a) as being anticipated by Barton et al. (6,280,598).

Claim 35: Barton et al. disclose an electrolyte composition, comprising about 2 to about 23 percent by weight of ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or

a mixture thereof in volume of total solution (col. 3: 12-22, and col. 4: 53-59 wherein Barton discloses 1 % to 33% w/v).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1, 5-8, 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Emesh et al. (2002/0108861)

Claim 1: Emesh et al. in Figure 4 disclose a method for planarizing a surface of a wafer comprising polishing the wafer (60) in an electrolyte composition comprising a phosphate system, wherein the wafer is connected to an electrical power source (90). *Pg. 4, para 0046*

Emesh et al. do not disclose a pH from about 3 to about 10.

Emesh et al. on page 5, paragraph [0055], lines 15-22 disclose that various conditions of the electrochemical planarizing process can be adjusted.

- Therefore, in light of the teaching of Emesh et al. it would have been obvious to one having ordinary skill in the art at the time the invention was made to have adjusted the pH of the electrolyte so to provided suitable control over the uniformity and rate of removal of metal thereby improving product quality and overall process efficiency.

Claim 5: As to the recitation "the electrolyte composition comprises about 2 to about 30 percent by weight of the phosphate system in volume of total solution", the rejection is as set

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forth above in claim 1 wherein Emesh et al. teach adjusting various conditions of the electrochemical planarizing process.

Claim 6: Emesh et al. disclose that the electrolyte composition further comprises one or more additives selected from the group consisting of benzotriazole and citric acid (page 3, paragraph [0038], and [0041]).

Claim 7: Emesh et al. disclose that the electrolyte composition further comprises one or more additives selected from the group consisting of ethylenediamine and amino acids (page 3, paragraph [0038], and [0041]).

Claims 8 and 10: As to the recitations “wherein the electrolyte composition comprises about 0.01 to about 2 percent by weight of benzotriazole in volume of total solution” in claim 8, and “wherein the electrolyte composition comprises about 0.01 to about 2 percent by weight of benzotriazole in volume of total solution and about 2 to about 15 percent by weight of ethylenediamine in volume of total solution” in claim 10, the rejection is as set forth above in claim 1 wherein Emesh et al. teach adjusting various conditions of the electrochemical planarizing process.

Claim 11: Emesh et al. further disclose removing copper atoms from the wafer (page 1, paragraph [0010], lines 8-13; page 2, paragraph [0015], lines page 4, paragraph [0046], lines 18-22).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

WO 02075804, published 26 September 2002, discloses a method of planarizing a surface of a wafer comprising an electrolyte comprising ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or a mixture thereof. However, WO 02075804 does not qualify a prior art as the filing date of the instant case (21 December 2001) is earlier than the date of the prior art.

WO 9965072 discloses a method of planarization of metal interconnections in semiconductor wafer manufacturing without the necessary physical contact with the wafer or direct electrical connection thereto using an electrolyte comprising ammonium tripolyphosphate or ammonium phosphate.

US 2001/0036746 a method of polishing a semiconductor device wherein, the polishing method including the steps of interposing an electrolytic solution including a chelating agent between a cathode member and the copper film, applying a voltage between the cathode member used as a cathode and the copper film used as an anode, wherein further the electrolyte may also comprise a brightener such as copper phosphate.

US. Patent No. 6,106,728 discloses a method of planarizing or polishing a wafer wherein a nonelectrolytic slurry is passed through an ion exchange resin to remove excess ion and then recycled to the wafer.

Allowable Subject Matter

9. Claims 12-34 and 43 are allowable over the prior art of record.

10. Claims 2-4, 9, 36-38 and 40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for indicating Allowable Subject Matter

11. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record discloses a method of planarizing a surface of a wafer comprising an electrolyte comprising a phosphate system, and a method of anodizing (coating) a metal surface with an electrolyte comprising a phosphate system wherein the phosphate system comprises ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or a mixture thereof, and a method of flowing a nonelectrolytic slurry through an ion exchange resin prior to recycle to the substrate.

In contrast, the claimed invention requires a method of planarizing a surface of a wafer comprising an electrolyte comprising ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or a mixture thereof, and a method of flowing an electrolyte through an ion exchange resin to remove ion prior to recycle to the substrate.

Therefore, a search of the prior art of record failed to reveal or explicitly teach, alone or in combination, what is instantly claimed: in particular,

A method for planarizing a surface of a wafer, comprising: connecting the wafer to a positive terminal of an electrical power source; disposing the wafer in an electrolyte composition comprising ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or a mixture

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thereof, and removing materials from the surface of the wafer disposed in the electrolyte composition.

For this reason, claim 12 and claims 13-19, which are dependent thereon, are patentably distinct from the prior art of record.

A method for planarizing a surface of a wafer, comprising: connecting the wafer to a positive terminal of an electrical power source; disposing the wafer in an electrolyte composition comprising ammonium dihydrogen phosphate, benzotriazole, and ethylenediamine; and removing materials from the surface of the wafer disposed in the electrolyte composition.

For this reason, claim 20 and claims 21-25, which are dependent thereon, are patentably distinct from the prior art of record.

A method for electrochemically polishing a wafer, comprising: providing a wafer having metal atoms disposed on a surface thereof; disposing the wafer in an electrolyte composition comprising ammonium dihydrogen phosphate, diammonium hydrogen phosphate, or a mixture thereof; flowing the electrolyte composition through an ion exchange resin to remove the metal ions from the solution; and recycling the electrolyte solution to the substrate.

For this reason, claim 26 and claims 27-34, which are dependent thereon, are patentably distinct from the prior art of record.

A method for electrochemically polishing a wafer, comprising: providing a wafer having metal atoms disposed on a surface thereof; disposing the wafer in an electrolyte composition;

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flowing the electrolyte composition through an ion exchange resin to remove the metal ions from the solution; and recycling the electrolyte solution to the substrate.

For this reason, claim 43 is patentably distinct from the prior art of record.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (703) 306-9072.

The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (703) 308-2383. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Thomas H Parsons
Examiner
Art Unit 1745


Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700